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GEOLOGY OF THE BRIERY CREEK TRIASSIC BASIN, VIRGINIA

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The Briery Creek basin is located in the Piedmont physiographic province south of the town of Hampden-Sydney in Prince Edward County, Virginia (Figure 1). The basin is centrally depicted on the Hampden-Sydney 7.5-minute quadrangle (Figure 2). At its maximum dimensions, the basin is 1.2 miles wide (east-west) and 4.4 miles long (north-south). Previous references to the basin include the aeromagnetic map of Virginia (Zietz and others, 1977), gravity map of the basin (Johnson and others, 1985), and the 1986 Virginia Field Conference guidebook (Goodwin and others, 1986). The basin is a half graben containing Triassic-age sedimentary rocks and is surrounded by a terrane of folded and faulted Precambrian-Paleozoic metasedimentary and igneous rocks. The eastern boundary of the basin is in fault contact with garnetiferous schist. The western margin of the basin is in contact with epidote-rich mylonite which is up to 300 feet wide. West of the mylonite is a feldspar-rich amphibolite gneiss. Sediments deposited in the Briery Creek basin were determined to be middle Carnian (late Triassic) based on age-restricted palynomorphs and megafossils (Robbins, USGS, personal communication, 1986).

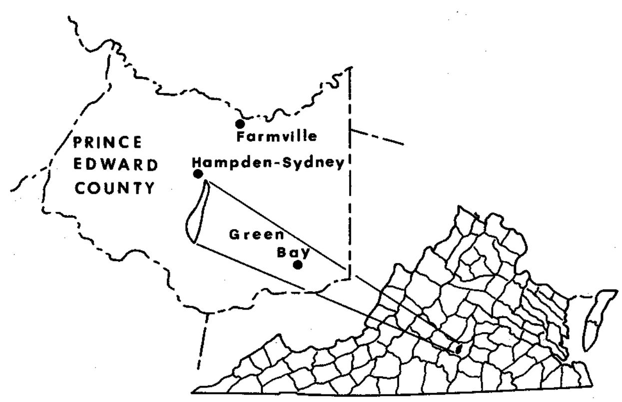

Figure 1. Location of the Briery Creek Triassic basin.

Excellent exposures of Triassic sedimentary rocks were made during the construction of the Bush River watershed dam and spillway sites 1E (Figure 3). Other good exposures were found in stream beds within the confines of the basin. A limited amount of subsurface information was obtained from core samples in the dam-site area.

The Briery Creek basin contains rocks of Triassic and Jurassic ages and is part of a central rift belt in the Piedmont province of Virginia. To the north of the Briery Creek basin is the Farmville basin, and to the south, along structural trend, are the Roanoke Creek, Randolph, and Scottsburg basins. Rocks within the Briery Creek basin are similar to those of the southern portion of the Farmville basin but are quite different from those of the Roanoke Creek basin. Those of the Roanoke Creek basin are almost entirely cobble and boulder conglomerates (Ramsey, 1982), whereas very little of this variety of conglomerate is found within the Briery Creek basin.

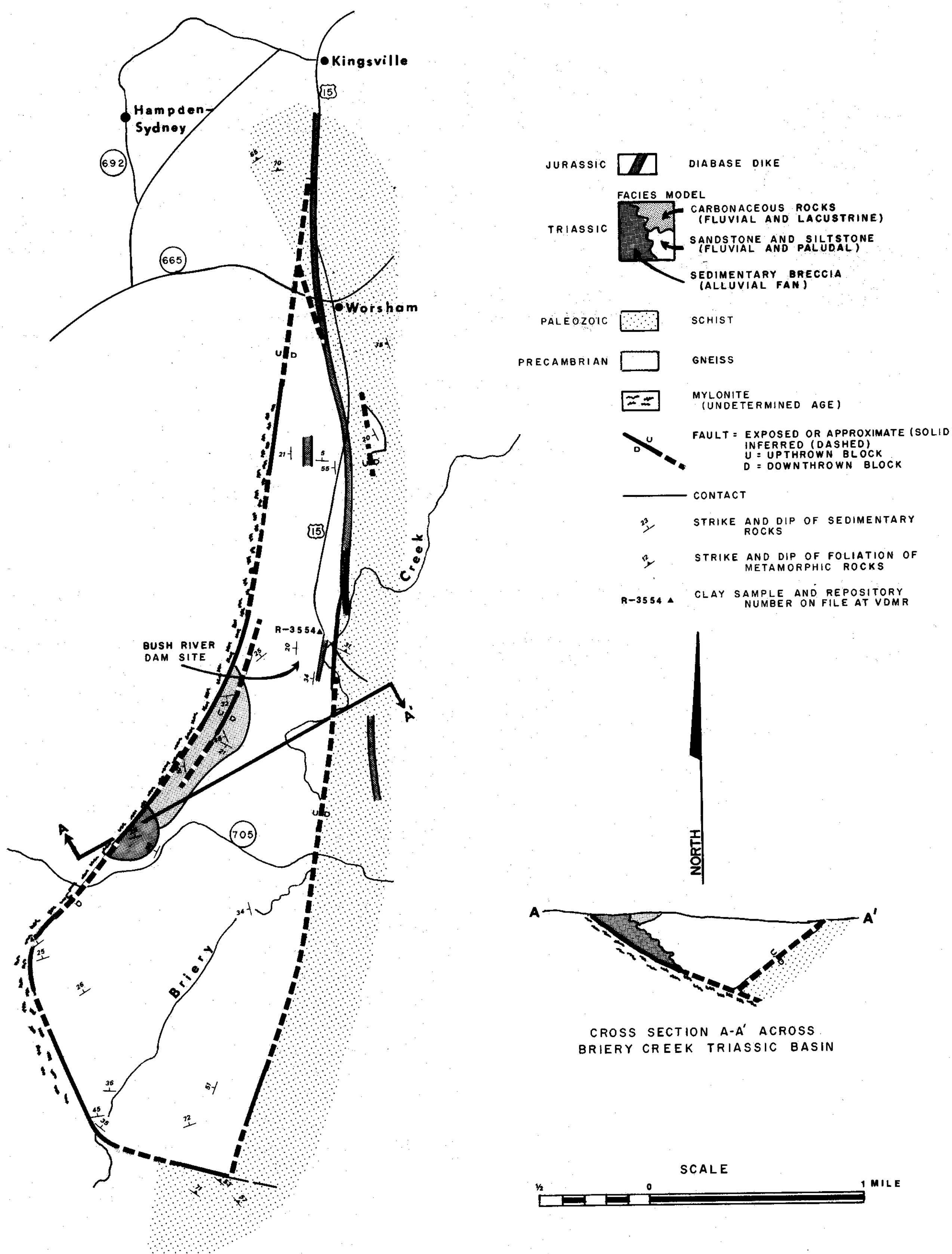

Figure 2. Geology and cross section of the Briery Creek Triassic basin.

Figure 3. Spillway constructed at the Bush River watershed dam site 1E, looking north. Mylonite exposed at extreme left of photograph; note eastward dip of Triassic sedimentary rocks below dump truck.

Within the Briery Creek basin are sedimentary breccia, conglomerate, sandstone, siltstone, shale, and thin coal beds. These sedimentary rocks can be interpreted to represent three distinct environmental units: a sandstone/siltstone unit which represents fluvial (river) and paludal (marsh) environments; a dominantly carbonaceous unit which is representative of fluvial and lacustrine (lake) environments; and sedimentary breccia unit which is interpreted as an alluvial fan deposit. All the sediments deposited in the basin are time-correlative and share a facies relationship with each other.

The greater portion of the basin is composed of the sandstone/siltstone unit. The siltstone is either buff or maroon and contains plant debris (Figure 4). At the spillway site and in drill core, well-formed desiccation cracks are preserved in the siltstone (Figure 5). Randomly oriented muscovite is a common mineral constituent in all the siltstones and sandstones. The sandstone is red or light gray,

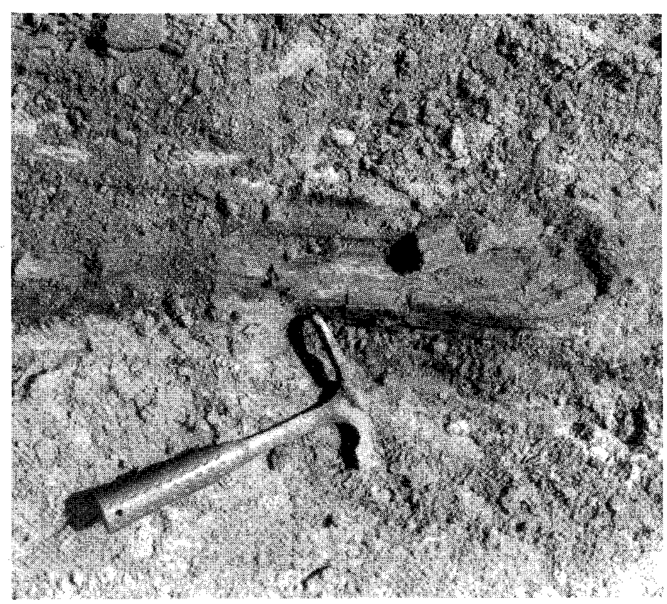

Figure 4. Part of a fossil tree preserved in siltstone.

moderately-well sorted, and massive. It is cross-bedded and contains quartz-pebble conglomerates which can be found in beds up to 1 foot thick. The contact of the sandstone with underlying siltstone is unconformable and irregular, and clasts of siltstone and carbonaceous material can be found near the base of the sandstone unit (Figure 6). The upper contact of the sandstone with the siltstone is abrupt and planar.

The second recognizable environmental unit is composed of dominantly carbonaceous rocks. It is smaller in extent than the sandstone/siltstone unit and is limited to the western portion of the basin.

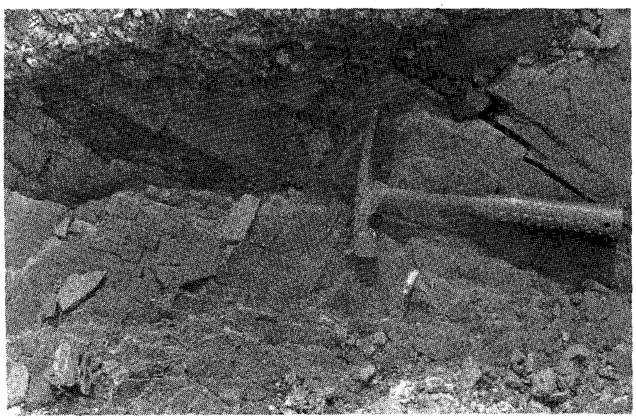

Figure 5. Desiccation cracks in bedding of siltstone.

Figure 6. Carbonitized plant fragment near base of channel sandstone.

It is composed of carbonaceous shale, carbonaceous siltstone, and noncarbonaceous, cross-bedded sandstone. Randomly oriented muscovite is common to all the rocks in this unit. Adjacent to the western boundary at the widest part of the basin is a 30-foot section of carbonaceous rock composed of sandy siltstone and shale. Within this section is a 6-inch coal bed which grades above and below into carbonaceous shale. At least three repetitive sequences involving a carbonaceous shale are noted in a 20-foot vertical section of rock (Figure 7). Ball and pillow structures are found within this unit (Figure 8) and almost all shale beds are slickensided. Coatings of gypsum, calcite, pyrite, chalcopyrite, ilmenite, and quartz are commonly found on carbonaceous shale bedding surfaces. Smoky quartz crystals (0.25 inch in length) were collected from these same surfaces near the contact with the western border fault. This same mineral occurrence has been observed at the western border of the Richmond basin.

Figure 7. Looking south at west-dipping cyclically deposited sedimentary rocks. Bush River watershed dam site 1E.

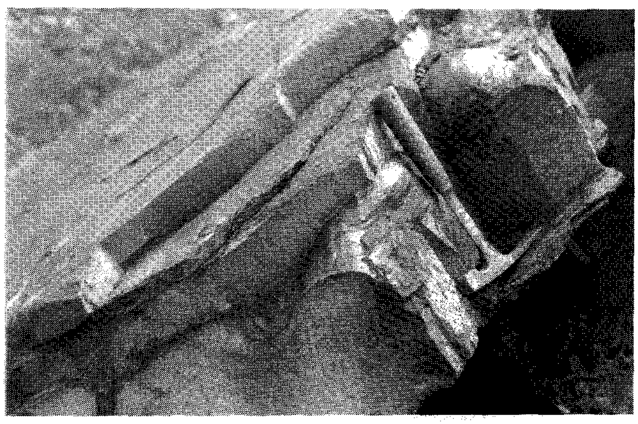

Figure 8. Ball and pillow structure in sandstone.

The third environmental unit is the sedimentary breccia deposit which is seen in one outcrop adjacent to the western mylonite. The breccia has subrounded gneiss clasts up to 1 foot in diameter and a matrix of red, course-grained sandstone. Randomly oriented muscovite is found within this rock type.

Diabase dikes up to 50 feet wide are common in the region and intrude both the Triassic sedimentary rocks and the Piedmont crystalline rocks that surround the basin. These dikes postdate known tectonic events in the area and are probably Jurassic in age. The dikes trend roughly north-south and one partially follows the trend of the eastern border of the basin, leading to speculation that it was injected along the prexisting border fault.

Most sedimentary rocks in the basin dip to the west; several exceptions are the rocks in the west-central part of the basin which dip eastward (Figure 3). These eastward dips result from interbasinal faulting that affects the orientation of the sedimentary rocks. One of these faults, exposed during construction of the spillway, has an identical trend to that of the western border fault.

The areal extent of this basin was undoubtedly larger in the geologic past than it is today. The basin was formed in response to regional faulting which produced grabens and half grabens. Regional drainage was diverted into this low-lying area, thus initiating fluvial and paludal sedimentation. Fining-upward sequences of the preserved sediments and a relative lack of alluvial fan deposits indicate that the lowering of the basin floor was dominantly gradual rather than rapid. This is in contrast to both the Farmville and Roanoke Creek basins which contain large volumes of alluvial fan deposits. When there was a temporary cessation of basinal lowering, shallow anoxic lakes were formed. The proximity of anoxic lake deposits to the western border fault suggests that small-scale alluvial fans may have interrupted the flow of paleodrainage. The sediments deposited during at least three lake events are preserved as cycles in the basin stratigraphy. Because of the conditions that existed in the anoxic lake, concostricans and various plant life were preserved by subsequent sedimentation. During times of relative quiescence, and before sediment lithification, there may have been earthquake activity as indicated by the ball and pillow structure. Late in the formation of the basin, there was a reactivation of the western border fault which tilted most of the previously flat-lying sediments westward. Interbasinal faults may have formed to take up the strain of the tilting. Lateral movement within the sedimentary strata also occurred for the same reason, causing development of slickensided surfaces on the bedding planes of the less competent beds. During the early Jurassic, diabase dikes were injected throughout the area, transecting both the Piedmont country rock and the lithified Triassic sediments.

Mineral resources that occur in the Briery Creek basin area include coal, clay materials, and stone for use as aggregate. Coal was discovered on the land of Mr. Flournoy in 1833 (Bradshaw, 1955). In 1837, Mr. Flournoy petitioned the Virginia State Legislature in the name of the Prince Edward Coal Company to mine and sell coal. In 1844, W. B. Rogers reported, "The nearest to a seam of valuable extent is presented on the land of Mr. Flournoy, situated near the southern extremity of the small oval patch of middle secondary [Triassic] lying south of Prince Edward C. H. [Court House]. Here the seam, as explored by a small shaft, is associated with brownish sandstones and shales, and is said to have measured nearly two feet in thickness." The shaft was not found during present field investigations, but local residents said such a mine was known to exist. Although coal produced from this mine was used only for local and domestic needs, the site represents the second coal area in Virginia to be developed. The first coal discovery in Virginia was in the Richmond Triassic basin. The Piedmont Coal Company mine located north of Farmville was third, opening in 1860, and also mined Triassic coal (Wilkes, 1982).

One sample of residual clay from Triassic shale in the Briery Creek basin was tested by Sweet (1973) and found suitable for use in most structural clay products, including face or decorative brick (R-3554 on Figure 2). If the total shrinkage is reduced by addition of a nonplastic grog (burned clay), it may also have a possible use for sewer pipe.

During construction of the spillway for Bush River watershed dam, the excavation cut into a greenstone mylonite. A portable crusher was installed at that site and the unsized crusher-run rock was used for the foundation of the dam. No physical testing has been done on this material for possible suitability as roadstone.

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NEW PUBLICATIONS

Roadside Geology of Virginia, by Dr. Keith Frye of Old Dominion University is a well-illustrated, 256-page publication describing interesting geologic structures, rocks, and scenic features which can be seen from the highways of Virginia. The origin of these features and the general geology of the State is discussed. This can be ordered for $13.15.

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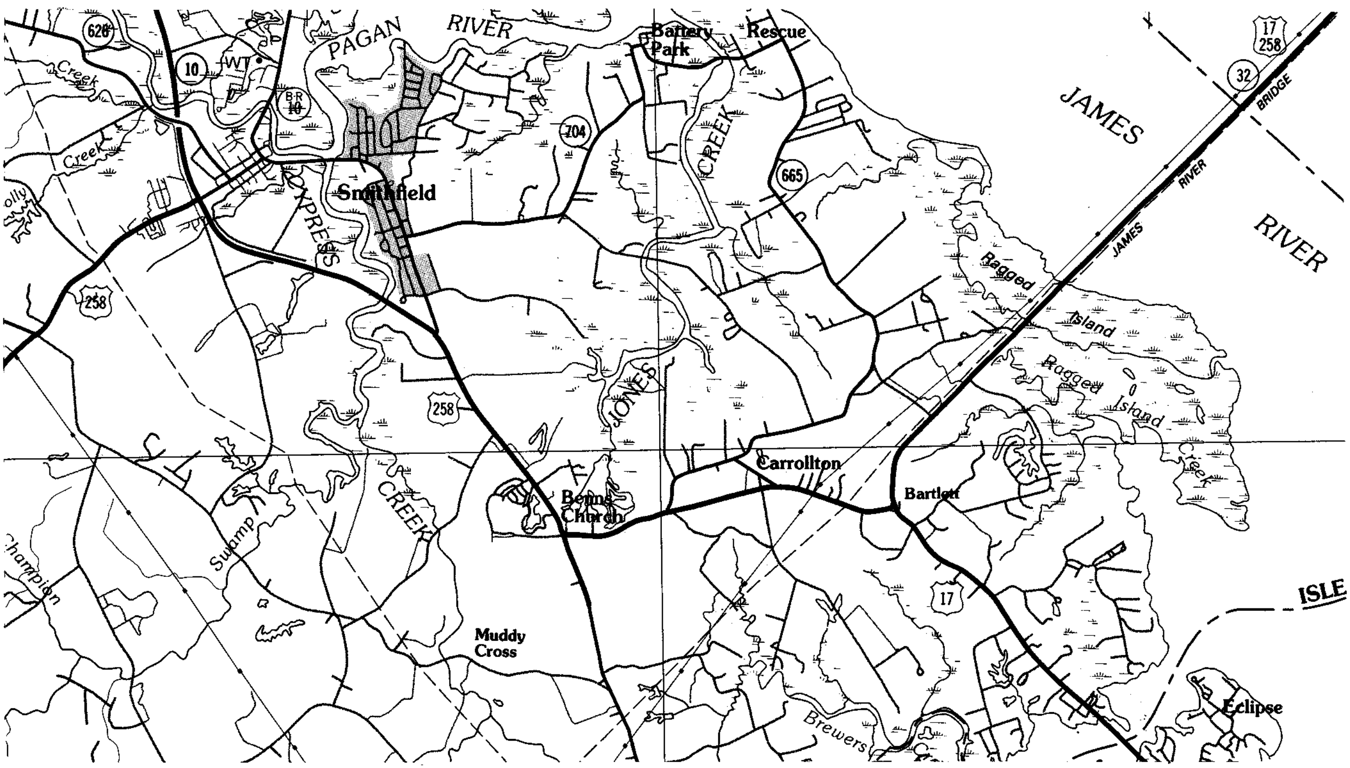
Orthophotoquads, black and white aerial photographs showing the same area as their corresponding topographic map, are in preparation for coverage of 14 counties across the State.

Henry and Prince William county topographic maps are in preparation. These 1:50,000-scale county maps show detailed cultural and physical information, are completely updated, and are reviewed by regional planning commissions. Twenty-one county topographic maps are available across the State.

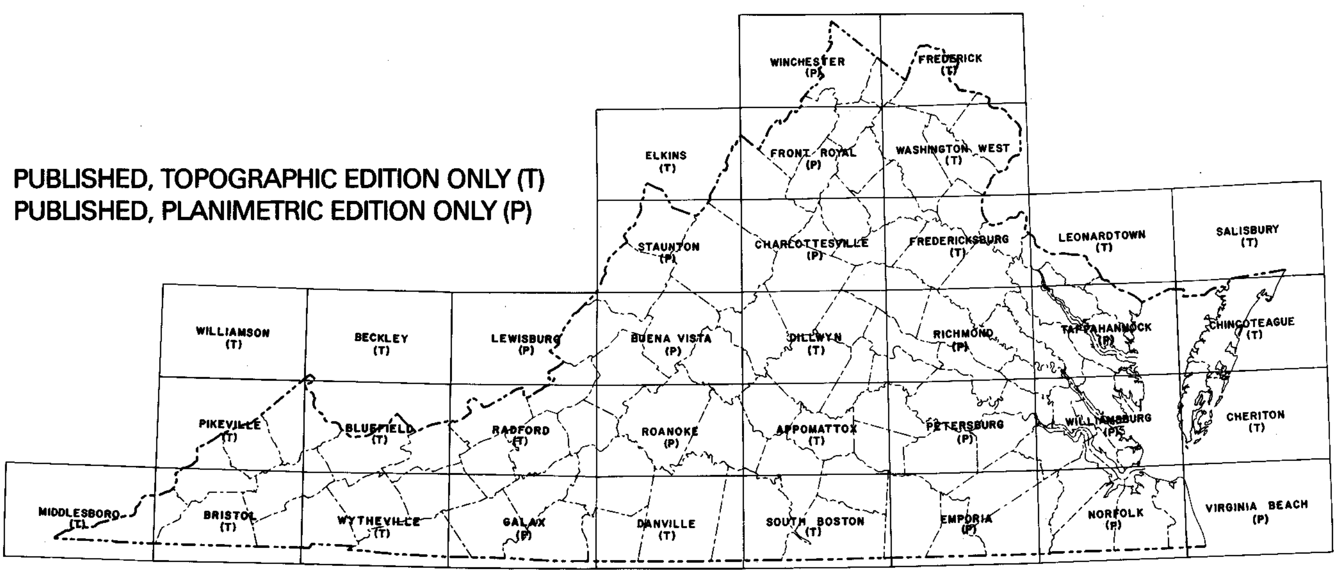
State coverage, as 34 separate 1:100,000-scale regional maps, is now available from the Division of Mineral Resources. Each depicts roads, city and county boundaires, streams, reservoirs, maintained trails, utility lines, and railroads by color or symbols and place names. A side panel indicates symbols used. Each map depicts a rectangular area of about 1900 square miles, and some show the shape of landforms by contour lines. Information shown on the map has been updated from new features interpreted from aerial photographs. These maps are useful for planning, for gaining a better idea of Virginia's geography, and for the 1990 population census. Each sells for $4.00 plus State sales tax.

False-color satellite image maps are in preparation for the Roanoke 1:250,000-scale area and for the southern portion of the Chesapeake Bay at the 1:100,000 scale.

Dates of current and historical topographic maps, a listing of orthophotoquads, and index status maps of available county and intermediate scale maps are available through the Division of Mineral Resources. Errors found on maps as well as new types of maps needed should be reported to the Division.



Selected portions of the Norfolk 1:100,000-scale map. Complete maps measure approximately 22 x 35 inches.



Index map for 1:100,000-scale regional maps.

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